

SRB CRITICAL ITEMS LIST

SUBSYSTEM: THRUST VECTOR CONTROL

ITEM NAME: Manual Shutoff Valve Assembly

PART NO.: 10201-0046-802 (Valve) FM CODE: A04
Includes

Fitting, Connector
10209-0034-801
Manual Shutoff Valve
Outlet Lines and Fittings
Rigid Lines
10201-0003-105
10201-0003-108 (Alt.)
10201-0003-106
10201-0003-109 (Alt.)
Elbow
10209-0067-801
10209-0132-801 (Alt.)
Connectors
10209-0028-801
10209-0034-801
Plug Bleeder
MS24391J4L
MS24391S4L
O-rings
Type M83248/1

ITEM CODE: 20-01-38

REVISION: Basic

CRITICALITY CATEGORY: 1

REACTION TIME: Seconds

NO. REQUIRED: 4

DATE: March 1, 2001

CRITICAL PHASES: Final Countdown, Boost

SUPERCEDES: March 31, 2000

FMEA PAGE NO.: A-130

ANALYST: B. Snook/S. Parvathaneni

SHEET 1 OF 4

APPROVED: S. Parvathaneni

FAILURE MODE AND CAUSES: Rupture caused by:

- o Material defect
- o Manufacturing defect

FAILURE EFFECT SUMMARY: Fire and explosion will lead to loss of mission, vehicle and crew.

REDUNDANCY SCREENS AND MEASUREMENTS: N/A

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RATIONALE FOR RETENTION:

A. DESIGN

- o The Manual Shutoff Valve Assembly is designed and qualified in accordance with end item specification 10SPC-0081. (All Failure Causes)
- o Valve is designed for proof pressure 1.5 times maximum operating pressure and burst pressure 2.5 times maximum operating pressure. Actual burst during qualification testing occurred at 20,750 psig which is over six times operating pressure. (All Failure Causes)
- o Valve material is 455 stainless steel. (Material Defects)
- o Inlet and outlet ports are MS33649 fluid bosses. (Manufacturing Defect)
- o Materials are selected per MSFC-SPEC-522. (Materials Defects)
- o Fluid procurement is controlled by SE-S-0073. (Material Defects)
- o Hydraulic fluid is MIL-H-83282 or MIL-PRF-83282 which was developed to minimize fire hazard. (Manufacturing Defects)
- o The aft skirt area is purged with GN2 prior to APU startup per OMRSD File II, Vol. 1, requirement number SOOFMO.430. This reduces O2 concentration to less than 4%. (All Failure Causes)
- o Qualification testing verified design requirements as reported in Kaiser Electro Precision Qualification Test Report RYY-204-032 and supplemental Qualification Test report RYY-204-036, Rev. Basic. (All Failure Causes)

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B. TESTING

- o Acceptance testing is performed by Kaiser Electro Precision ATP RYY-104-039, on each new unit. This includes visual examination, cleanliness verification, proof pressure test to 4875 psig and leak tests for five minutes at 3250 psig with leakage insufficient to form a liquid drop. (All Failure Causes)
- o During refurbishment and prior to reuse, the Manual Shut Off Valve Assy.is reworked per 10SPC-0131 and acceptance tested by USA SRBE/TBE Florida operations per the criteria of 10SPC-0081. This includes visual examination, cleanliness verification, proof pressure test to 4975 ± 100 psig and leak test for five minutes at 3300 ± 50 psig with leakage insufficient to form a liquid drop. (All Failure Causes)
- o Individual tube assemblies are hydrostatically proof tested prior to installation per 10REQ-0021, para. 2.3.3.5. (All Failure Causes)
- o Individual tube assemblies are helium leak tested per 10REQ-0021, para. 2.3.3.6. (All Failure Causes)
- o The manual shut-off valve fluid connections are leak tested during hydraulic system leak check with helium to an acceptable level per 10REQ-0021, para. 2.3.3.3 except the bleeder plug at the service panel. (All Failure Causes)

- o Visual leak check of hydraulic circuit (system) joints is performed per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)
- o Hydraulic circuit fluid leak test is performed per 10REQ-0021, para. 2.3.12.2. prior to hotfire. (All Failure Causes)
- o Hydraulic system helium leak test is performed per 10REQ-0021, para. 2.3.3.3 prior to hot fire. (All Failure Causes)
- o Functional test is performed during hotfire operations per 10REQ-0021 which includes: (All Failure Causes)
 - Low speed GN2 spin, para. 2.3.11
 - High speed GN2 spin, para. 2.3.15
 - Hotfire, para. 2.3.16
- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)

C. INSPECTION

I. VENDOR RELATED INSPECTIONS

- o Material certifications verified by USA SRBE PQAR per SIP 1180. (Material Defect)
- o Manufacturing is verified by Source Inspection Plan. (Manufacturing Defects)
- o Penetrant inspections verified by USA SRBE PQAR per SIP 1180. (Manufacturing Defect)
- o Verification of sectioning of a lot sample to verify penetration is performed by USA SRBE PQAR, per SIP 1180. (Manufacturing Defect)
- o Assembly verified by USA SRBE PQAR per SIP 1180. (Manufacturing Defect)
- o Acceptance test witnessed by USA SRBE PQAR per SIP 1180. (All Failure Causes)
- o Critical processes/Inspections:
 - Weld per RYY-104-042
 - Penetrant per MIL-STD-6866 (Kaiser RYYO2-028)
 - Heat Treat per RYY-115-022

II. KSC RELATED REFURBISHMENT INSPECTION

- o Visual inspection of Manual Shutoff Valve will be performed per 10SPC-0131, para. II. (All Failure Causes)
- o Functional testing of Manual Shutoff Valve will be performed per 10SPC-0131, paragraph IV.

All manual tests will be witnessed by Quality or verified for those instances when controlled software is utilized and a test report is generated. (All Failure Causes)

III KSC RELATED ASSEMBLY AND OPERATIONS INSPECTIONS

- o Hydraulic fluid leak test is witnessed/verified per 10REQ-0021, para. 2.3.12.2 prior to hotfire. (All Failure Causes)
- o Hydraulic fluid is verified for cleanliness and composition (purity and particulate count) prior to introduction on board the flight hardware per 10REQ-0021, para. 2.3.2.6 and during prelaunch per OMRSD File V, Vol. I, requirement number B42HP0.010. (Material Defects)
- o Verification of hydraulic fluid (effluent) sampled for moisture and dissolved air content per OMRSD File V, Vol. I, requirement number B42HP0.011 and .070 respectively. (Material Defects)
- o Individual tube assemblies are inspected for the requirements of 10PRC-0038 per 10REQ-0021, para. 2.3.0. (All Failure Causes)
- o Hydrostatic test is verified per 10REQ-0021, para. 2.3.3.5. (All Failure Causes)
- o Individual tube assemblies helium leak test verifies acceptable leakage per 10REQ-0021, para. 2.3.3.6. (All Failure Causes)
- o Individual tube assemblies are precision cleaned by USA SRBE per 10REQ-0021, para. 2.3.0. (All Failure Causes)
- o Hydraulic fluid is verified for cleanliness and moisture content from actuators and reservoirs per 10REQ-0021, para. 2.3.12.3 (Material Defects. Contamination)
- o Performance of visual leak check of hydraulic circuit (system) joints per 10REQ-0021, para. 2.3.12.2. (All Failure Causes)
- o Proper function of TVC system is demonstrated during Hotfire operations per 10REQ-0021 to include: (All Failure Causes)
 - Low speed GN2 spin, para. 2.3.11
 - High speed GN2 spin. para. 2.3.15
 - Hotfire (Includes verification of rock and tilt reservoirs to between 50 and 90 percent), para. 2.3.16
- o Inspect TVC system for damage - no leaks, signs of rubbing or discoloration are allowed per 10REQ-0021 following low speed GN2 spin, para. 2.3.11.3, and high speed GN2 spin, para. 2.3.15.5. (All Failure Causes)
- o Post hotfire damage inspection for leaks, signs of rubbing or discoloration is performed per 10REQ-0021, para. 2.3.16.4. (All Failure Causes)
- o Prelaunch hydraulic system leak test is performed per OMRSD File V, Vol. 1, Requirement Number B42HP0.020. (All Failure Causes)

D. FAILURE HISTORY

Criticality Category 1:

- o Failure Histories may be obtained from the PRACA database.

E. OPERATIONAL USE

- o Not applicable to this failure mode.